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TWO IMPORTANT SCALE INSECTS AND THEIR CONTROL

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The orchard interests of this State are yearly becoming of greater and greater importance. There are many hundreds of acres of peach trees in Alabama from which the owners expect an adequate return for the capital invested and for the labor expended upon them. This acreage is constantly being increased and the importance of our peach orchard interests can hardly be too strongly emphasized. Our peach trees, however, do not constitute our only orchard interests. The pear and apple are grown here to a not inconsiderable extent. Large orchards of both of these fruits now exist in the State and each year sees new trees planted in such situations as seem adapted to their successful culture.

In a view of this subject, however, we cannot justly confine ourselves to a consideration of the large, the commercial orchard, alone. Scattered over the State are hundreds of small orchards, a few trees or perhaps a few dozen trees planted and maintained for the sole purpose of supplying the family with fresh fruit in its season. The money value of these family orchards can hardly be computed, yet to our people they mean much. Indeed we can fairly consider the total of our orchards both from the point of view of the commercial orchardist and from the point of view of the small owner as of vast and increasing importance to the State.

The orchards of Alabama however valuable they may be do not

constitute our only interests in the growing of fruit trees. There are many individuals and firms to-day engaged in the nursery business, the growing of trees for the purpose of sale to prospective and actual orchardists both in this and in other States. There are in Alabama some sixty firms and individuals engaged in this line of work and their yearly output of orchard trees is approximately nine million. A large total to be sure and it represents an interest of vast importance to our people and not alone to those directly engaged in the business but to many others who are indirectly affected by its success or failure.

There can be no question as to the value of the orchard and nursery business in Alabama and an interest of such great importance as this demands the very best endeavors of those who are engaged in it. The man who is successful as a grower of fruit or as a nursery owner knows that his success has not just happened but that it is due in large measure to his careful work and effort and to his willingness to accept the experience of others as an aid to his endeavors. When insect pests threaten his crop and perhaps even the life of his orchard or nursery, the work of great importance to him is the destruction of the unwelcome insect, though he will first have done all in his power to keep the pest outside his orchard boundaries. Indeed this idea of keeping the undesired insect out is considered of such importance that we find the Horticultural laws of the State so framed that the dissemination of certain insect pests and fungous diseases through affected nursery stock is rendered almost impossible. The law reads, in part, as follows:

SEC. 4.—The State Horticulturist or a deputy duly authorized by the Board of Horticulture, shall have power under the regulations of the Board of Horticulture to visit any section of the State where such pests are supposed to exist, and to determine whether any infested trees or plants are worthy of remedial treatment or shall be destroyed, and he shall immediately report his findings in writings, giving reasons therefor, to the owner of the infested plantation, his agents or tenant, and a copy of each report shall also be submitted to the said board.

* * * * *

SEC. 5.—Upon the findings of the State Horticulturist or his deputy in any case of infested trees or plants, the treatment prescribed by him shall be executed at once, (unless an appeal is taken), under his supervision, the cost of material and labor shall be borne by the owner, *provided,* however, that in case the trees or plants shall be condemned they shall be destroyed by the State Horticulturist and the expense of such action shall be borne by the owner. No compensation shall be allowed for any plants that shall be destroyed.

* * * * *

SEC. 7.—It shall be unlawful to offer for sale, sell, give away, or transport perennial plants, scions, buds, trees, shrubs, vines or other plants, tubers, roots, cuttings, bulbs, known to be infected with dangerously injurious insects or plant diseases.

* * * * *

SEC. 11.—It shall be unlawful for any person, firm or corporation to sell, give away, or ship within the State of Alabama any trees or shrubs or any other plants commonly known as nursery stock, without having a certificate of guarantee of the State Horticulurist of Alabama.

* * * * *

SEC. 13.—No transportation company or common carrier shall deliver any box, bundle, or package of trees, shrubs, or plants commonly known as nursery stock to any consignee residing within the State of Alabama when said box, bundle or package does not bear the official tag or certificate of guarantee issued by the State Horticulturist without previously notifying the State Horticulturist of the shipment as they may be required by the board, nor without duly warning the consignee of the risk in accepting said shipment.

* * * * *

While the law in large degree protects the prospective planter of trees from the introduction of pests and diseases it remains with the orchardist and nurseryman to destroy the pest if it does gain a foothold on his properties.

The State Board of Horticulture of Alabama has among other insect pests declared the so-called San Jose (San Ho-say) Scale (*Aspidiotus perniciosus* Comst.) and the New Peach Scale (West Indian Peach Scale. *Aulacaspis pentagona* Targ. [*Diaspis amygdali*]) to be dangerous and to constitute infestation when present on trees or shrubs.

These two most dangerous and destructive insect pests are present in parts of Alabama and it is the purpose of this circular to draw especial attention to them at the present time. While there is now no data at hand directly referring to the control of these insects under the conditions of climate characteristic of this State still the writer believes that the experience gained in other States may well be applied here in the lack of such experimental data. The recommendations made therefore may be considered as based on the writer's own experience in another State and upon the experience of the States immediately adjoining us.

THE SAN JOSE SCALE.—*Aspidiotus perniciosus* Comst.

The San Jose Scale was introduced to this country in shipments of trees from either Japan or China many years ago. It first found a lodgement in the orchards about San Jose in California and soon proved itself a formidable enemy to the orchards of that region. It did not confine its work of destruction to fruit trees but proved

itself to be a very general feeder and its pernicious work was soon widespread on the Pacific coast. From that region it has gradually spread over nearly if not quite all the States of the Union and the financial losses caused by it have been and are enormous. It has met and is meeting the active opposition of those interested in its destruction and this opposition has developed certain lines of treatment that have proved effective in many observed cases. These methods of treatment however depend for their success upon the careful and intelligent work of the tree owner and in too many cases the work has been neither carefully nor intelligently done. The result of this has been that the scale was not destroyed and the impression was fostered that attempts at control were a useless expenditure of time and money.

This feeling is not justified by the facts and the writer believes himself justified in saying that the presence in an orchard of the San Jose Scale or its absence therefrom is a matter entirely within the control of the orchard owner. The control methods that have been most successful will be discussed in a later paragraph (page 6).

How to Recognize the San Jose Scale.

The San Jose Scale belongs in that group of insects known as the armored scales. This means that the living insect is covered over with an armor like shell which is composed of the cast skins (*exuviae*) of the creature and of a waxy material secreted by it. This armor-like covering is conical in form, of a dirty grayish color with the cast skins darker and occupying the apex of the cone. The individual scales are very minute seldom being greater than from ½ millimeter to one millimeter (1-50 to 1-25 inch) in diameter at the base. If this armor is carefully removed with a needle or pin the living insect beneath can be seen. It is almost round in form and of an orange yellow color. When so exposed the insect does not move away. It is at this stage of its life entirely sedentary remaining fixed to its food plant by its sucking mouth parts and devoting all of its energies to the business of reproducing its kind and eating. When the attack of the scale is severe the whole portion of the tree affected becomes crusted over with the older scales, the younger and living insects being partly or completely covered by these remains of older generations. By the time this condition supervenes the tree is usually so severely injured that its recovery can scarcely be expected though the insects may be destroyed. If the orchardist finds his trees affected by insects such as these described he may justly suspect the presence of San Jose Scale. Further if he finds upon cutting away the bark beneath the suspected insects that it is discolored and appears pink ranging to dark red and black through to the wood then there can be little doubt that the San Jose Scale has obtained lodgment upon the trees. It is not the purpose nor scope of this circular to give a technical description of the insects treated

of in it. If the orchard owner even suspects the presence of the San Jose Scale or of any other noxious insects upon his trees he should immediately send a description of the trouble together with some small part of the infested portion of the tree to the Entomologist of the Agricultural Experiment Station at Auburn. The trouble will be looked into and treatment suggested.

Character of Injury.

The injury done by the San Jose Scale, as indeed is the case with most scale insects, does not consist so much in the amount of sap taken by them as food as in another and more serious strain upon the tree due to their attack. Each scale insect upon the tree has punctured the bark with its lance-like mouth parts and while indeed much sap may be used as food by them yet the further effect of this puncturing of the bark is to cause a very serious stoppage in the sap flow. This is due to the fact that the walls of the cells that go to make up the plant become thickened and abnormal where the puncture occurs. This may be due to the mere mechanical injury of the puncture or may also be due to the secretion by the scale of some irritant material. This irritant material causes an excessive flow of sap to the injured region and a thickening of the cell walls follows. The final result of this thickening is that in the attacked region we have a condition that may be described as "bark bound" and the sap flow is very seriously impeded. To the amount of sap taken by the insects, which under normally healthy conditions of growth would mean little to the tree, we must add then this stoppage of sap flow. The total of these two losses may mean the death of the tree.

The New Peach Scale (*West Indian Peach Scale.*)

Aulacaspis pentagona Targ. (*D. amygdali.*)

The New or West Indian Peach Scale is, like the San Jose Scale, an imported insect pest. When and how it made its way to our country is of small moment so far as the purpose of this circular is concerned. As its name indicates it probably originated in some of the West Indian islands and found its way here in shipments of either trees, shrubs, or fruits. It soon established itself and is now well distributed over the country. While it is, perhaps, not so universally present as is the San Jose Scale still it has well proved its adaptability to various climatic conditions. It is present and injurious in this State, Alabama, and the writer has observed it in California. While it is, perhaps, an easier scale insect to destroy than are some others that the orchardist may have to deal with, still its possibilities for destructive work are quite great enough to warrant the ban that has been placed upon it in this State. The same methods of treatment used in the control the San Jose Scale are successful in destroying the New Peach Scale.

How to Recognize the New Peach Scale.

The New Peach Scale is a member of the armored scale group and what was said in reference to that group in describing the San Jose Scale applies to the insect now under consideration. Save for this one item of armor however there is no marked similarity between the two insects.

The careful observer will note the fact that where this scale is present both round and elongate specimens are found. The round and larger scales harbor the females while the elongate and smaller ones cover the males. The color of the insects exposed by removing the scales is yellow to orange while the covering scale is dirty white. The cast skins of the insects found upon the apex of the cone of the scale are yellow in color. When the number of insects present becomes great, which soon occurs once a lodgment is secured, the tree or affected limb appears to be covered over with a coating of rather dirty cotton lint. Indeed this incrusted appearance is quite characteristic of the attack of this insect. No marked discoloration of the bark is to be seen as a result of the insect's attack.

Character of Injury.

The injury done by the New Peach Scale may be considered to consist both in the amount of sap taken as food and in the mechanical injury to the tree. This mechanical injury has been referred to in a previous paragraph (p. 5) and is probably the greatest factor in the matter of scale injury. The New Peach Scale obtaining its food, as do all scale insects, by puncturing the attacked growth with its lance-like mouth parts, causes the mechanical injury which finally results in a stoppage of the sap flow. As with the San Jose scale this mechanical injury plus the amount of sap taken as food may and frequently does result in the death of the tree. While this death of the tree may not immediately occur the reduction in vitality consequent upon the attack of the scale renders the infested orchard unprofitable.

Under the conditions then, of an attack upon the trees of an orchard by either of the two scale insects noted in these pages it behooves the orchardist to see to it that the offending insects are destroyed.

Remedial Measures.

Both the San Jose Scale and the New Peach Scale have been found to be destroyed by the same methods of work and by the same materials so that what may be here said in regard to remedial measures can be considered as applying to both of these insects.

As has been stated in a previous paragraph the San Jose Scale was introduced to this country by way of California and in that State the first successful battle for its control was fought. It is not

necessary here to go into the detail of the many experiments which finally lead to the success mentioned. Suffice it to say that of the many materials experimented with all were finally discarded save one. This one is the so-called Lime-Sulfur-Salt wash and it is to-day after many experiments and changes in the formula for its preparation the standard material for the control of the San Jose Scale and many other noxious insects both in California and in many other parts of the world.

The Lime-Sulfur-Salt Wash.

Formula.—The formula recommended here is a modification of the formula given in University of California College of Agriculture, Bulletin No. 144, page 42, and is as follows:

Lime	30 pounds
Sulfur	20 pounds
Salt	5 pounds
Water	60 gallons

This formula is about the same strength as that recommended on page 21, Bulletin 14, Georgia State Board of Entomology and will be effective if properly prepared.

*Preparation**—"For preparing the wash two vats or boilers are necessary, and if the spraying is to be done on large scale, one of these at least should hold a couple of hundred gallons. If a smaller number of trees are to be treated iron kettles will answer the purpose. Of course the preferable way of cooking the wash is by means of live steam.

Many ways have been suggested for mixing the materials, but the results are the same in every case so long as the mixture has been subjected to the required amount of boiling. It is largely a matter of convenience, then, that determines the particular method, and the one found to best answer this requirement is as follows:

First place two or three inches of water in the boiler, and to this add the sulfur, which has previously been made into a paste by mixing with hot water in order to remove the lumps, or sift the dry sulfur through a mosquito wire netting and stir it thoroughly. Then add about one-fourth of the lime, and when the violent boiling has ceased add another fourth and so on until the required amount of lime has been added. Hot water should be added with the lime as needed, so as to make the mixture a creamy consistency. Too much water will "drown" the lime while on the other hand too little will cause incomplete slaking of the lime. In this way the heat generated by the slaking lime is taken advantage of, and, by adding the sulfur first, plenty of time is given for removing the lumps.

By the time the lime is thoroughly slaked the fire should continue the boiling, so that the time of boiling begins with the addition of

*From U. of Cal. Agri. Ex. Sta. Bul. No. 166.

the lime. The salt and about one-fourth of he water should now be added and the whole boiled from one to two hours, keeping it frequently stirred in the meantime. At the end of this period screen into the spray tank add the necessary amount of *hot* water and apply to the trees hot.

The wash when properly made is a heavy reddish-brown liquid, very caustic and having a strong sulfur odor. The heavier materials settle upon standing, leaving a lighter liquid both in color and weight.

Application—On account of the heavier ingredients of the wash quickly settling to the bottom, means should be provided for agitating the mixture in the spray tank. This is best done, of course, by the power outfit. In the absence of this a gearing may be attached to the wheel of the wagon and the mixture agitated while going from one tree to another. A still simpler way is to stir frequently by means of a hoe or paddle.

The nozzle should be of the stopcock type, which will permit of ready cleaning. The type of spray should be a rather coarse one which will thoroughly wet the insects * * * * Thoroughness of application cannot be too strongly urged, and *no part of the tree should escape treatment.*"

Time of application.—The Lime-Sulfur-Salt wash is for winter use only. It must not be used when trees are growing for very grave injury will be the result if it is applied at that time. When the trees are dormant it can be safely used upon them. Such weather conditions in the winter as will permit work in the orchard will be satisfactory for applying the Lime-Sulfur-Salt wash.

The application of the wash need not be extremely expensive for one may employ any of the outfits of pumps, etc., commonly sold for for use in orchards.

We believe that by carefully carrying out the recommendations of this circular two very important insect enemies of our orchards can be eliminated.

The writer of this circular, the Entomologist of the Agricultural Experiment Station of the Alabama Polytechnic Institute at Auburn, Alabama, will be glad to consult with orchardists and those interested in the Horticultural and Agricultural advancement of the State in any case of insect injuries to trees or crops. If the presence of noxious insects is even suspected please send to the writer specimens of the insect and its work and recommendations will be made in the matter. Do not send the material in envelop only; it is liable to be crushed in transit. Do not send in bottles for the material sent usually decays in these. Send either in wooden or cardboard box and besides the address put your own name and address on the outside of the package.